

## ACVR1 gene

activin A receptor type 1

### Normal Function

The ACVR1 gene provides instructions for making the activin receptor type-1 (ACVR1) protein, which is a member of a protein family called bone morphogenetic protein (BMP) type I receptors. BMP receptors span the cell membrane, so that one end of the protein remains inside the cell and the other end projects from the outer surface of the cell. This arrangement allows receptors to receive signals from outside the cell and transmit them inside to affect cell development and function.

The ACVR1 protein is found in many tissues of the body including skeletal muscle and cartilage. It helps to control the growth and development of the bones and muscles, including the gradual replacement of cartilage by bone (ossification). This process occurs in normal skeletal maturation from birth to young adulthood.

The ACVR1 protein is normally turned on (activated) at appropriate times by molecules called ligands. Activation may occur when these ligands, such as BMPs or a protein called activin A, attach (bind) to the receptor or to other proteins with which it forms a complex. Another protein called FKBP12 can turn off (inhibit) ACVR1 by binding to the receptor and preventing inappropriate (leaky) activation in the absence of ligands.

### Health Conditions Related to Genetic Changes

#### Fibrodysplasia ossificans progressiva

Mutations in the ACVR1 gene cause fibrodysplasia ossificans progressiva, a disorder in which muscles and connective tissue such as tendons and ligaments are gradually replaced by bone (ossified). The formation of bone tissue outside the skeleton freezes joints and limits movement in affected individuals. The most common mutation, which occurs in all individuals with the classic features of the condition, substitutes the protein building block (amino acid) histidine for the amino acid arginine at position 206 of the ACVR1 protein (written as Arg206His or R206H). Other mutations in the ACVR1 gene cause rarer forms of the condition that can be more severe and often involve skeletal abnormalities, such as multiple abnormally formed fingers and toes.

Studies show that the R206H mutation changes the shape of the ACVR1 protein. This shape change disrupts the binding of the inhibitor protein FKBP12. As a result, the

receptor is constantly turned on (constitutively activated), even in the absence of ligands. Other *ACVR1* gene mutations result in a receptor protein that is turned on by ligands more easily than the normal version of the protein. Too much receptor activity causes overgrowth of bone and cartilage, resulting in the signs and symptoms of fibrodysplasia ossificans progressiva.

## Other Names for This Gene

- activin A receptor type I
- activin A receptor, type I
- activin A receptor, type II-like kinase 2
- activin A type I receptor
- activin A type I receptor precursor
- ActR-IA protein, human
- ACTRI
- ACVR1\_HUMAN
- ACVR1A
- ACVRLK2
- ALK2
- hydroxyalkyl-protein kinase
- SKR1

## Additional Information & Resources

### Tests Listed in the Genetic Testing Registry

- Tests of *ACVR1* ([https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=90\[geneid\]](https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=90[geneid]))

### Scientific Articles on PubMed

- PubMed (<https://pubmed.ncbi.nlm.nih.gov/?term=%28ACVR1%5BTIAB%5D%29+OR+%28ALK2%5BTIAB%5D%29+OR+%28SKR1%5BTIAB%5D%29+OR+%28ACTRI%5BTIAB%5D%29%29+AND+%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D>)

### Catalog of Genes and Diseases from OMIM

- ACTIVIN A RECEPTOR, TYPE I (<https://omim.org/entry/102576>)

### Research Resources

- ClinVar ([https://www.ncbi.nlm.nih.gov/clinvar?term=ACVR1\[gene\]](https://www.ncbi.nlm.nih.gov/clinvar?term=ACVR1[gene]))
- NCBI Gene (<https://www.ncbi.nlm.nih.gov/gene/90>)

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## Genomic Location

The ACVR1 gene is found on chromosome 2 (<https://medlineplus.gov/genetics/chromosome/2/>).

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